

The influence of deformation phenomena on heterogeneous fluid flow behaviour in granular media

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The pore network of granular media can be controlled by the particle shape, particle size distribution and the degree of inter-particle consolidation. Sedimentary processes, such as those observed in the formation of Aeolian sandstones, can result in layered gradations and variable flow properties. Whilst particle rearrangement can be initiated by global processes (e.g. liquefaction) or localised ones (e.g. shear deformation bands). Where inter-particle attrition occurs, both the particle size distribution and the degree of consolidation can be significantly altered. This project aims to determine the process-structure-property relationships for granular media subjected to deformation processes and the resulting altered flow. Discrete Element Modelling (DEM) simulations of the deformations will be complemented by triaxial cell experimental studies combined with 3D particle imaging using X-ray Computed Tomography. The bulk fluid flow properties will be determined under confined stress conditions experimentally, and analysed at pore scale using the Lattice Boltzmann Method (LBM) for computational fluid dynamics.